

CLAIMS:

1. A self-aligning coupling device for installation in a channel having an open end and a pair of substantially parallel side walls, the device including:

an elongate connecting portion having a longitudinal axis;

5 a channel abutment portion; and

at least one laterally projecting lug,

arranged such that in use the coupling device may be installed in the channel with the channel abutment portion located at least partially within the channel and the laterally projecting lug located outside the open end of the
10 channel,

the channel abutment portion being formed such that when aligned in a first angular position within the channel it abuts at least one said side wall of the channel to prevent rotation of the device in a first rotational direction about said longitudinal axis, while allowing rotation in a second, opposed, rotational
15 direction, and

the lug being formed such that in said first angular position it extends beyond at least one of the side walls of the channel, whereby when the coupling device is retracted into the channel while simultaneously applying a torque to rotate the device in said first rotational direction towards said first angular
20 position, the channel abutment portion will abut the side walls of the channel thereby aligning the lug to extend beyond at least one of the side walls of the channel to prevent the coupling device from being fully retracted into the channel.

2. The self-aligning coupling device of claim 1 which includes two opposing laterally projecting lugs formed to extend beyond both side walls of the channel
25 when the coupling device is aligned in the channel in said first angular position.

3. The self-aligning coupling device of claim 1 or claim 2 wherein the lug or lugs are formed so that when they are aligned substantially parallel with the side walls of the channel they are able to fit therebetween such that the coupling device is able to slide freely within the channel.

4. The self-aligning coupling device of any one of the preceding claims wherein the channel abutment portion is formed such that when the lug or lugs are aligned substantially parallel to the side walls of the channel the channel abutment portion is aligned within the channel in a second angular position at which it abuts the side walls of the channel to prevent rotation of the device in said second rotational direction about said longitudinal axis, while allowing rotation in said first rotational direction.

5. The self-aligning coupling device of any one of the preceding claims wherein the elongate connecting portion includes a cylindrical portion having a thread formed thereon for screw thread engagement with a cooperatively threaded adjustment member.

6. The self-aligning coupling device of claim 5 wherein the thread is formed such that torque is applied to the coupling device due to friction between the thread of the elongate connecting portion and the cooperative thread of the adjustment member.

7. The self-aligning coupling device of claim 6 wherein the thread formed on the elongate connecting portion is manufactured so as to be a snug fit with the cooperatively threaded adjustment member such that friction is increased therebetween.

8. The self-aligning coupling device of claim 6 wherein a thin coating of material, such as a wax or lacquer, is applied to the thread formed on the elongate connecting portion so as to increase friction between the thread of the elongate connecting portion and the cooperative thread of the adjusting member.

9. The self-aligning coupling device of any one of the preceding claims including two lugs integrally formed at an end thereof to form a head portion having a substantially rectangular cross section.

10. The self-aligning coupling device of claim 9 wherein the dimension of the rectangular cross section of the head portion along a major axis thereof is greater

than the channel width such that when located outside the open end of the channel with said major access perpendicular to the channel walls, corresponding with the first angular position, the lugs prevent the device from being fully retracted into the channel.

- 5 11. The self-aligning coupling device of claim 9 or claim 10 wherein a dimension of the rectangular cross section of the head portion along a minor axis thereof is less than the channel width to enable the head portion to fit between the side walls of the channel when aligned with the minor axis perpendicular to the channel walls, corresponding to the second angular position.
- 10 12. The self-aligning coupling device of any one of claims 9 to 11 wherein the substantially rectangular cross section of the head portion includes rounded portions at corners thereof to prevent corresponding edges of the head portion catching on the surface of an object in which the channel is formed, when rotating between the first and second angular positions.
- 15 13. The self-aligning coupling device of any one of claims 9 to 12 wherein one or more edges and corners located at the end of the head portion are rounded or smoothed to ensure there are no angular corners or edges that may catch on a surface of an object in which the channel is formed when the device slides within the channel.
- 20 14. The self-aligning coupling device of any one of claims 9 to 13 wherein the head portion includes surfaces formed to bear against corresponding surfaces adjacent to the open end of the channel.
- 25 15. The self-aligning coupling device of any one of claims 1 to 14 wherein the channel abutment portion includes two pairs of flat surfaces, each pair of surfaces meeting at an edge therebetween and said pairs being substantially opposed to each other relative to the longitudinal axis of the coupling device.
16. The self-aligning coupling device of claims 15 wherein each of said pair of surfaces meet at right angles and are arranged such that in each of said first and

second angular positions one of each of said pairs of surfaces bears against a respective side wall of the channel.

17. The self-aligning coupling device of either claim 15 or claim 16 when dependent upon any one of claims 9 to 14 wherein said pairs of surfaces are
5 opposed along an axis oriented at 45 degrees to the major and minor axes of the rectangular cross section of the head portion of the coupling device.

18. The self-aligning coupling device of claim 17 wherein the channel abutment portion is tapered, such that a width thereof proximate to the head portion is greater than a width proximate to the connecting portion.

10 19. The self-aligning coupling device of claim 17 or claim 18 wherein the channel abutment portion is formed integrally with the head portion, such that one of each of said pairs of surfaces is continuous with a corresponding surface of the head portion located on a side parallel to the major axis of the substantially rectangular cross section.

15 20. The self aligning coupling device of any one of the preceding claims further including at least one nib for engagement with a corresponding recess in an adjustable engagement assembly, the nib and recess being arranged such that when engaged the coupling device is retained in an angular position relative to the engagement assembly suitable to enable the complete clamping assembly
20 formed thereby to be inserted into a corresponding recess or cavity in an object to be clamped with the coupling device oriented in said second angular position within a channel of said recess or cavity.

21. The self-aligning coupling device of any one of the preceding claims which is formed as a single integral part.

25 22. The self-aligning coupling device of any one of the preceding claims which is formed in at least two cooperating parts.

23. The self-aligning coupling device of claim 9 which is formed in two parts, the first part including the head portion and channel abutment portion and the second part including the elongate connecting portion.

24. The self-aligning coupling device of any one of the preceding claims wherein the first and second angular positions are aligned substantially at right angles to one another.

25. An adjustable clamp assembly including:

a self-aligning coupling device in accordance with any one of the preceding claims; and

an adjustable engagement assembly operatively engaged with the coupling device such that an adjustment of the engagement assembly results in a translation of the coupling device along the longitudinal axis while simultaneously applying a torque to the coupling device about the longitudinal axis.

26. The adjustable clamp assembly of claim 25 wherein the elongate connecting portion of the self-aligning coupling device includes a cylindrical portion having a thread formed thereon, and the adjustable engagement assembly includes a cooperatively threaded adjustment member,

whereby in use the adjustment member is in screw thread engagement with the elongate connecting portion, such that a rotation of the adjustment member results in translation of the coupling device along the longitudinal axis while simultaneously applying a torque to the coupling device about the longitudinal axis.

27. The adjustable clamp assembly of claim 26 wherein the application of torque results from friction between the thread of the elongate connecting portion and the cooperative thread of the adjustment member.

28. The adjustable clamp assembly of any one of claims 25 to 27 wherein the adjustable engagement assembly includes:

a first gear member having centrally a first axis of rotation; and

a second gear member having centrally a second axis of rotation substantially perpendicular to said first axis and being cooperatively engaged with the first gear member such that rotation of the first gear member about the first axis results in rotation of the second gear member about the second axis,

5 wherein said second gear member includes an internally-threaded central rotatable sleeve member forming said cooperatively threaded adjustment member.

29. The adjustable clamp assembly of claim 28 wherein the first and second gear members include bevel gear members, and the adjustable engagement
10 assembly further includes a housing formed to retain therein said first and second bevel gear members in cooperative engagement with one another, the housing having at least one external surface that, in use, abuts a corresponding surface of an object to be clamped so as to function as a clamp member of the adjustable clamp assembly.

15 30. The adjustable clamp assembly of either claim 26 or claim 27 wherein the thread of the cylindrical portion is formed so as to be a snug fit with the cooperative thread formed on the adjustment member in order to increase the friction therebetween.

20 31. The adjustable clamp assembly of either claim 26 or claim 27 wherein a thin coating of a material such as a wax or lacquer is applied to the thread formed on the cylindrical portion of the self-aligning coupling device so as to increase friction between the thread formed on the cylindrical portion and the cooperative thread of the adjustment member.

25 32. The adjustable clamp assembly of any one of claims 25 to 31 wherein the self-aligning coupling device includes at least one nib and the adjustable engagement assembly includes a corresponding recess, said nib and recess being arranged such that when engaged the coupling device is retained in an angular position relative to the engagement assembly suitable to enable the clamping assembly to be inserted into a corresponding recess or cavity in an

object to be clamped with the coupling device oriented in said second angular position within a channel of said recess or cavity.

33. An adjustable engagement assembly adapted to function as a clamp member when used in a clamp assembly of the type having an elongate connection member with a threaded portion, the engagement assembly including:

a first bevel gear member having centrally a first axis of rotation;

a second bevel gear member including a central sleeve member having an internal thread for screw-thread engagement with a threaded cylindrical connection member, the second bevel gear member having centrally a second axis of rotation substantially perpendicular to said first axis and being cooperatively engaged with the first bevel gear member such that rotation of the first bevel gear member about the first axis results in rotation of the second bevel gear member about the second axis; and

a housing formed to retain therein said first and second bevel gear members in cooperative engagement with one another, and having at least one external surface that, in use, abuts a corresponding surface of an object to be clamped.

34. The adjustable engagement assembly of claim 33 wherein the housing includes a cylindrical channel that passes through said external surface, which is aligned with the sleeve member of the second bevel gear member so that, in use, a threaded connection member may be received via the channel to engage with the sleeve member.

35. The adjustable engagement assembly of claim 33 or 34 wherein the first bevel gear member includes a raised projection of circular cross-section, which is retained within a slot formed in an end face of the housing, the slot consisting of a substantially semicircular end portion having a diameter corresponding to that of the raised projection and an opposing neck portion having a slight narrowing at an opening adjacent to an open side of the cavity.

36. The adjustable engagement assembly of any one of claims 33 to 35 wherein the second bevel gear member includes a groove disposed about a

circumference thereof, and the housing includes two rib members disposed adjacent to the open side of the cavity and formed to engage within the groove to retain the second bevel gear member in position.

- 5 37. The adjustable engagement assembly of claim 36 wherein the rib members are inwardly curved and terminate in bezel-ended projections that engage within the groove.